



Bias Adjustment for AIRS

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Steps For the Adjustment

- Select the “truth”
- Select the correction model
- Collect Pairs of Observations “matches”
- Generate adjustment coefficients
- Apply the coefficients



Bias Adjustment Basics – Review

- Adjustment removes systematic errors from the observed minus calculated difference
- Correct the radiance difference
 - Corrects the retrievals
- Philosophy – Do no harm
 - Adjust the radiances at the retrieval step
 - Leave the stored radiances alone



Bias Adjustment Basics – Review

- Mathematical Considerations
- The solution is ill conditioned
 - Need to use a form of constrained regression
 - Several possible constraints work – more preference than performance
- Our Approach
 - Predict the difference between the observed and calculated values
 - Force the coefficients to be small
 - By suppressing the eigenvectors with the smaller eigenvalues
 - Use eigenvector regression
 - Can also add noise to constrain the solution
- If it is done right
 - Corrected value is equal to the measured value plus a small correction
- If wrong - other channels may be the major predictors



Sources of data

- Conventional radiosondes
- ACARS reports
 - Get error profiles near airports
 - Collocate with radiosondes to check radiosonde reports
- ARM data
 - Multiple sensors
 - Error characteristics are well characterized
- Buoys
- Surface observations
 - adjust near surface temperatures for time and space differences
- Ozone soundings
- GPS water vapor



Choices for Truth

- Radiosondes
 - Differences in observations times
 - Radiosondes are limited to the lower atmosphere
 - Moisture measurements are not accurate in dry/cold conditions
- Models
 - Good for early evaluations
 - Good for bias errors and removing space/time differences
 - Models can have errors
 - Models have an internal tuning
- ARM
 - Sample size small
- AIRCRAFT
 - Provide observations at single points
- LIDAR
 - Not readily available



Complete the Truth

- Need to calculate radiances to make the adjustment
 - Need to specify the complete profile
 - Radionsondes lack
 - Surface skin temperature
 - Upper atmospheric temperature
 - Trace gases
- use satellite retrieval
 - use satellite retrieval
 - use satellite retrieval



IR Bias Adjustment – Current Approach

- Adjust AIRS using AIRS as predictors
- Use separate coefficients for day and night
 - Short wavelength channels are the most difficult
- Predictors are 45 eigenvectors of scaled radiances plus up to 10 additional predictors
- 45 eigenvectors
 - Radiances divided by a typical noise value
- 10 additional predictors
 - Solar zenith angle, scan position, latitude



Microwave Bias Adjustment

- Adjust microwave using microwave as predictors
- Use separate coefficients for land, sea, and mixed
 - Microwave has large changes in surface emissivity
 - If the mixed coefficients are good enough, they can be placed in all 3 bins
- Predictors are 10 eigenvectors of brightness temperatures plus up to 10 additional predictors
- 10 additional predictors
 - scan position, latitude, percent of land



Microwave Adjustment – missing channel

- There is no channel 16
- Channel 16 is kept and filled with a missing value
- Approach for generating and using eigenvectors
 - Generate eigenvectors using 19 channels
 - Shift coefficients for channels 16-19 to locations for channels 17-20
 - Set the coefficient for channel 16 to zero



Current Status

- Coefficients for AIRS are generated
- Working on microwave – should be done next 2 weeks
- AIRS simulation results
 - Correction is perfect on simulated data
 - Data have no noise – perturbed and unperturbed used the same random seed
 - Result, the difference has zero error because the two identical errors cancel
- Just starting to look at team results – we are in an active phase with the team algorithm
- Plans
 - Run a tuning algorithm using HIRS data - should start end of June
 - Prototype some of the unanswered questions
- Complete definition
- write both detailed and general descriptions



Cloud Clearing

- Generated coefficients to predict AIRS from microwave
 - Had problems generating initial accuracy
- Getting recovered code to match coefficients with code
- Working with Mitch on clear tests